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ELEMENTS OF LIFE,
OR,
THE LAWS OF VITAL MATTER.

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Quoniam et ipsæ definitiones ex verbis constant, et *verba gignunt verba*, adeo ut necesse sit ad instantias particulares earumque series et ordines recurrere.

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The science of life moves within the sphere of language.

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APOLOGY.

THE “Elements of Life” contains the substance of a speech, which the author delivered before the Medical Society of Philadelphia.

The reception it met with, together with the request, since repeatedly made, for the publication of it, have induced him to commit it to the press.

In laying down the fundamental principles, the author consulted his own common sense. The orthodox principles of life he could never comprehend, and, not being deficient in vanity, he was led to doubt, whether his want of comprehension was owing to the imbecility of his understanding, or to the incomprehensibility of the principles ; whether the facts, that assailed his senses, were entitled to less credit than the *words* and *phrases* that contradicted them.

The result of his doubt was such as any one might have experienced, who had that independence of mind, which demands truth in possibility, and which questions the validity of facts, when

they are beyond the line of probability. The result was such as to convince him, that a certain kind of truth, acknowledged by mankind, was nothing but assent to certain words, that have an ideal and not a real meaning : ideal, because it was conceived at a period of life when the understanding was incapable of comprehending, and the judgment unequal to the task of deciding upon, the operations of matter.

Being well convinced of this, he was led to believe, that ideas of a certain kind were to be ascribed to an ignorance of the nature of the matter that produced them, and that the orthodox systems of life had imposed upon mankind, as a truth, a certain description of words, as false and devoid of the meaning which they inculcate, as the ideas which they represent. Hence he concluded, that as metaphysicians and even philologists had, instead of correcting those words, and adapting their meaning to the operations of matter, as these have become known, fabricated more in order to support them, he would, by avoiding their language, remain free from their errors.

Although this view of language reduces some of the now important systems of human nature to mere ideas and words, yet it does not impeach their fitness for moral and civil purposes. Mankind are as well governed by words as by facts, provided they are not employed as engines of ty-

ranny, or issued out like the infallible bulls of popery.

When ideal systems are liberalized and subjected to the political state, they form one of its strongest pillars, but when they usurp the philosophy of nature, and fasten Science within their convulsive grasp, the sword of Truth should rescue it, even at the loss of the right hand that holds it. In morals and in politics let such systems prevail! here let them be riveted! But suffer the physician, while he respects them, to promulgate others better calculated to advance his profession. The happiness of mankind depends, in part, upon the *true knowledge* of their physical constitution, and therefore, unless science be emancipated from the dominion of false theory, the exertions of philanthropy will be of no avail.

In the science of medicine, it is criminal to uphold immateriality. The ascription of disease to an immaterial cause has a fatal tendency, inasmuch as many rely upon such a cause to effect a cure—a circumstance that never happens. Madness, a disease of the mind, was perhaps never understood, and seldom cured, until a professor, distinguished alike for talents and piety, announced, that the *cause* of it was a morbid and irregular action of the blood vessels, which excited correspondent actions in the nerves. His numerous cures of it demon-

strate, at least, that it proceeds from a physical cause.

If, then, the mind can be physically regulated, almost made and unmade, by material means, should not the principle be extended to the whole phenomena of a living body? The author was of this opinion, and, therefore, if the fundamental principles of the "Elements of Life" have not been accommodated to orthodox theories, let the physical good he intends by it be taken as his apology.

PREFACE.

IN reasoning, by means of induction, or by writing in a philosophical language, in which no words are used but such as express ideas, that represent *real* objects, truth is made evident, and error is exposed.

Much address, however, is necessary in reasoning and writing upon subjects, to which scholastic logic and metaphysical ratiocination have been exclusively applied ; particularly in respect to the omission of certain words, which are assumed as data, reasoned upon and concluded to be true.

It is always the case with some reasoners, to define a word by means of other words, and thus constitute a proposition ; this expresses their ideas of things, and not the nature of the things ; places also ideas in the room of things, and, by presuming that things are conformable to ideas, affords conclusions from ideas, rather than from the things themselves. Thus the word *mind* is defined, according to their ideas of it, by the word *spirit* ; the definition of spirit is the word *soul* ; and soul is defined to be the *spirit* that pervades the universe. Here we find, differing only in form, by wanting adjunct words, a proposition, composed of words which convey their meaning

of the mind, and not the nature of the mind itself. But in reasoning by induction, we proceed from things in preference to the ideas of them, and therefore are obliged to *define definitions*, which are assumed as data, reasoned upon and concluded to be true. Hence, in reasoning by induction, our ideas must be opposed to those which are supposed to be true, inasmuch as ours are regulated by things; and, though we seem deficient in terms to express the phenomena of them, and use words that have an ideal and another meaning, yet the existence of the things must not therefore be doubted. If, in the use of words, we confound meanings, the fault must be ascribed to the present state of human knowledge, which does not furnish us with a requisite number of facts, their series, and order, to set aside ideal meanings. The outline of human nature may be now sketched in the language of induction, but to time and future discoveries must be left the correction of ideas, and the adaptation of words, that shall express life by the operations of matter, and mind by the motions of the nerves and brain.

In the discussion of the subject of life, we have said nothing concerning the materiality of the mind, because the arguments against it are founded in words and their propositions. The language of induction defines the mind to be the motions of the nerves, in unison with material impressions, and gives a real meaning to the "source of intelligence," from whence logomachists derive it, by making that source neither more nor less than the brain. The proofs, too, of the materiality of life are just so many demonstrations of the materiality of the mind; for, if life be nothing but matter, the mind, consequently, is a part of its phenomena. As the mind, in our consciousness, had

no existence until we realized it as the characteristic of a peculiar kind of body, its faculties and operations depend as much upon the mechanism of that body, as the circulation of the blood depends upon the action of the heart and arteries ; and as life is inseparable from the action of the heart and arteries, so also the mind is inseparable from that peculiar organization of matter. Hence the mind is evidently a part of the phenomena of life, and by proving, that the whole phenomena of it is matter, or the result of matter acting upon matter, we shall have established the materiality of the mind. Had we even minutely investigated the subject of the mind, and appealed to facts within the observation of every one, facts that admit of no dispute, still our labour would have been in vain. Had we shown that a child, in the early stage of infancy, had no consciousness of his existence ; that the progress of the mind is commensurate with the expansion of his body ; that the division of the nerves of a sense would prevent his acquisition of the ideas derivable from them, and that a division of the nerves of the five senses would destroy all his ideas ; that after his ideas were acquired, a very little ossification of his brain, would, by interrupting the synchronism and association of physical motions, make him an idiot ; or that madness, if he should unhappily fall into it, could only be cured by physical remedies, and his mind thereby restored ; we say, that had these facts, together with their application, been laid before the immaterialist, his imagination still would have prevailed over his understanding, and perhaps in the words of Mr. Locke, in *his scepticism*, he would have exclaimed, " Matter cannot think." Because a stone, or a tree, cannot think, though it be matter substantially different from

his own, his too, according to his ideas of it, cannot possess the faculty of thought.

Mr. Locke, throughout his writings, seems to have considered all matter as homogeneous : hence he could not account for the properties of a living body being so widely different from those of other bodies, without supposing that these properties were the effect of an immaterial principle.

Had he studied chemistry, and speculated less about first principles, he might have learned that homogeneous and heterogeneous matter are two very different substances ; and that the latter should therefore possess properties in the ratio of its substantial difference. Had he borne this distinction in his mind, he would have supposed it more natural, that thought should be the result of matter heterogeneously and peculiarly compounded, than that the compound should not possess thought. We should not talk about impossibilities before we know all that is possible. Mr. Locke's ingenious opinions, and subtle arguments, against the intelligence of matter, must not be imposed upon us as facts. That gentleman was a great writer, and, in his own way, a very acute reasoner ; absurdity never bore a stronger resemblance to truth, than when supported by his pen ; and if other such writers, particularly that " able reasoner," Dr. Clarke, had not refined upon Mr. Locke's refinement, his notions would have been less glaring. But Locke is buried in the grave of his own immateriality. If we have trodden barbarously upon his ashes, let us be punished with the weapon he has bequeathed ; let his numerous followers

define the *word* immateriality, and we will retrace our steps in real contrition. If they do so, we beg leave to caution them against Mr. Locke's data; the word *spirit, soul, &c.* want a definition just as much as the word immateriality, and if those cannot be refined to a substance, no matter how subtle, provided it be a substance, the *proofs* in favour of immateriality should be entitled to the same credit as the evidence of ghost seers. We ought to mention here, that certain metaphysicians have extricated the meaning of the word immateriality from its native nothingness, in the following definition: "Immateriality is infinite, and therefore not finite." We forbear, when we barely term this an absurdity; for if an infinite body (infinity without body is but a word) filled space, could finite bodies exist in the same space? If the sun filled the universe, could the planets exist in it? If the followers of Mr. Locke's immaterial system *will* presume to explain away these phenomena, and to talk of infinity, while finite bodies are plainly before them, surely common sense must not believe them. Nor let us be told, that the materiality of the mind is inadmissible, while the prevailing doctrines of moral evil and free agency are not refuted.

It would have been a useless task to have refuted words, that in their turn are refutable by other words, and we confess, that having paid but little attention to words and their propositions, we scarcely comprehend the meaning which the advocates of those doctrines have attached to *their* terms. Reasoning from facts, their series and order, moral evil signifies irregular and inordinate physical motion, motives to action, the prevalence and predominance of material impulses, at first instinctive, and

afterwards acquired by imitation and instruction, and the motive is either confirmed, altered, or reversed, by a promiscuous intercourse with men, in the vicissitudes of life, and in the exactions of social and civil society. Actions, thus constituted, become good or evil in proportion with their fitness or unfitness to the general or individual interest. Actions, thus constituted by physical motive, make us act necessarily when we seem to act freely. The involuntary motions of the heart and arteries, associated with the voluntary motions of the nerves and brain, the mind, indifferently obtain the ascendant, according to the nature and force of impressions ; when the latter are superior, we choose good and avoid evil, but the action is nevertheless a necessary one, because the motive to it was the consequence of impressions received in the brain, by means of the example of moral teachers, and the words that they *sounded* in our ears instituting a habit of action, sufficiently powerful to controul the grosser impulses (heart and arteries), which, if indulged too far, might be productive of evil. Hence, we necessarily choose good. But when salutary precepts have not been inculcated, or if the constitution is of a highly sanguine temperament, the heart and arteries, the sources of the passions, prevail over the emotions of the mind (the nerves) and establish a volition, which, though acting freely, is absolutely uncontrollable, except through fear of punishment, or of shame, which often, though not always, proves superior to the impulse of the passions : hence also we choose evil, when opposite and stronger motives do not prevail.

Volition is ever the slave of necessity. The idiot performs all his functions, except that of thinking, by means of impulses which he cannot avoid or restrain ; yet he can choose good and avoid evil, prefer a fish to a stone, when both at the same time are presented to him. His volition is instinctive, and if he enjoyed that higher degree of it called reason, his actions might become more complex and extensive, but they would result from the greater number of impressions and impulses of which he is accordingly susceptible. In the human system, effects continue long after their causes have ceased to operate. Associations of motions go on in the same order, notwithstanding the variation and extension of impressions ; while the causes, that first determined our actions, will be overlooked in the execution of them, and the *will*, the mere agent in the execution, will be supposed to be the sole cause of the action.

It is asserted by the advocates of free agency, that the mind is superior to the body, and that therefore the will must be pre-eminent and above controul. In reply to this assertion, we beg leave to appeal to Nature. Does she not at night, by abstracting light and sound, lock up the mind in sleep, and in the morning again awaken it, by restoring these agents ? and does she not, in this interval of intellectual death, carry on the action of the heart, the centre of her vital source, with the diminution only of a single pulsation ? yes ; and if man (if we may use the phrase) would attend to the silent expression of this fact, this simple fact, he would learn not only the minor importance and secondary consequence of his mind, but he would also discover the secret of his existence....the materiality of his life. From

that simple fact he might learn, that the system of Nature is a system of unity, in which multifarious operations are carried on by a single design; that the human system acts conformably to her law, and requires particular provision, only as it differs in the peculiarity of its matter: for as the leaves of the tree wither, as the summer's sun departs, so also our "noblest faculties" cease, when light, heat, and sound are abstracted; as the tree dies when deprived of moisture, so life ceases if air be abstracted. But man, perhaps, will never learn that unity is the great attribute of Nature. While bookish philosophers, who are always the authorities, ascribe her operations to a rule the reverse of that by which she carries them on, and who will declare themselves *their own* free agents, though at the same time they are but the freest agents of her design, acting agreeably to her destiny; Nature must move in the eccentric course of ideas, and man derive his sustenance from the "vital ether" of a "nether world."

Unacquainted with any facts relative to the primordial operations of Nature, we have not troubled the reader with an account of the origin either of planetary or of human creation. If we have spoken of chemical affinity, uniting the elements of matter, and giving them their known forms, we mean only the expression of the fact which Nature makes evident to the senses. The series and order of the union of the elements are altogether unknown. The genius of Darwin has indeed illuminated the "temple of Nature," and exposed to view, in a series and order of successive transformations, the various forms of vitality, from the original germ, to a body possessed

of thought. We must, however, remark, that that "temple of Nature," was the work of his imagination, and the beings which issued from it, the offsprings of its toil. Nature, in this particular, has kept her secret safe by taking away the consciousness of each mode of existence. Man can only know himself as man. If, agreeably to Darwin, man sprang like the insect from the soil of Nature, like it, he buzzed the hour away with merely instinctive life. If, in the successive composition and decomposition of his embryo forms, he at last walked erect, the "paragon" of animals, he must have lost all consciousness of the means by which he arrived at perfection, in the experience of the ends that completed his destiny. His destiny thus being completed, "spontaneous vitality" ceased, and, accordingly, cannot be known but in the *language* of poetical inspiration. But Darwin was a poet, who, like others, had that madness of inspiration, which makes men and worlds out of language. We, who knew not the *sense* of poetical language, who were not adroit in personification, were obliged to speak simply of the operations of matter, and to rest satisfied with the demonstration of the nature of vital composition.

We have said nothing concerning a First Cause, because we know nothing of its nature. We feel it, we adore it, but cannot comprehend its quality. The expositions of it are merely the ideas of it, and are not a real representation of a First Cause. We believe it to be material, as otherwise it must be but an "airy nothing" or a word. There is nothing besides matter ; if we pass that, we fall into a vacuum. Little does the immaterialist suspect that, in *strict sense*, his system is an atheistical

one ; and still less will he be disposed to believe, that our faith, heathenish as it may seem, is yet as pure as his own. He, without doubt, means to be right, but if he coolly define the *meaning* of the words which he worships, he will not think us very wrong, or impiously disposed, in having referred them to matter, in order that we might *comprehend* the *existence* of a *First Cause*.

ELEMENTS OF LIFE.

“ THE common properties of matter are extension, impenetrability, inertia, attraction, motion, and rest, all of which, except the *two last*, which cannot *exist together*, are found in all bodies whatsoever.” But Nature, by means of a law, manifests two characteristics, by which matter may be distinguished.

1st, Gravitation and attraction, which takes place between the homogeneous particles of matter.

2d, Chemical affinity, which takes place between the heterogeneous particles of matter. Gravitation and attraction and chemical affinity, however, mutually govern the homogeneous and heterogeneous particles of matter : thus, the compositions and decompositions of the animal and mineral kingdoms are examples of their reciprocal influence.

3d, Chemical affinity unites heterogeneous particles of matter, and forms compounds, some of

which are animals and vegetables. Thus a nerve, a muscle, a bone, &c. constitute an animal; the fibre, the bark, the leaf, &c. constitute a vegetable. Each of these substances is composed of chemical elements.

4th, Animals and vegetables, thus constituted, possess sensibility and imitability, according to the nature of the compounds. These properties are the result solely of chemical organization: thus, in an animal, irritability and sensibility are destroyed by abstracting any one of the chemical elements, oxigene, carbone, and azote; and in a vegetable, irritability is destroyed by the abstraction of carbone, or water, which is composed of oxigene and hydrogen.

5th, Animals and vegetables, thus constituted, possess general and individual actions. Respiration, digestion, assimilation, secretion, and excretion are the individual actions; collectively, they are the general actions which constitute an action in the system, one and indivisible, called life; a compound body, possessed of physical and chemical motion, and governed by chemical laws*.

* By the physical motion of a vital body, we mean muscular and nervous (intellectual), which are also chemical, inasmuch as they are the consequence, or rather concomitant, of the action of chemical matter, particularly oxigene. A muscle cannot contract without being acted upon, either by oxigene within its substance, or by the agency of oxigene, when it acts in

Having premised these fundamental propositions, grounded upon experiments to be mentioned hereafter, we shall, in the mean time, proceed briefly to consider the opposite systems of life,

combination with other matters. A fœtus in utero moves chiefly by means of oxygenated blood derived from the mother, and it ceases to move shortly after the circulation is cut off from the umbilical vein.

This is confirmed by experiments made on bitches. We therefore conclude from *visible* facts, that life is a compound body, which is possessed of physical and chemical motion, and governed by chemical laws, for *all matter obeys its own laws*.

But as physical and chemical motion have been attributed to a vital principle, and this again to something else, we will, for the sake of coming to a conclusion, refer them to a mechanical principle; and though we may make a distinction of kinds of motion, we cannot make any in the principle itself. That truly great mathematician, sir Isaac Newton, seems to have overlooked his own principles, when he attempted to make an exception in principle of the motion of a vital body. It seemed to have escaped him, that the laws which governed the universe, governed also every atom of known existence; and that heterogeneous matter, according to its nature, should have motion different from homogeneous, and which, at the same time, should be according to a material principle, by the rule that matter obeys its own laws. But the motion of all bodies is mechanical, which is produced by the action of other bodies. That the motion of a vital body (mental and material) is excited only by the action of other bodies, must be admitted, until it can be *shown*, that a vital body, after being deprived of air and food, can retain its motion, either in the spontaneous movement of the entire body, or in the act of intelligent communication.

and to examine fairly the arguments that have been deemed satisfactory and conclusive in their defence. In the literary works of Aristotle, Plato, Hippocrates, Van Helmont, Staal, Hunter, and others of inferior note, we obtain no information concerning life, other than their definitions contain, and all these teach us is, that the 'psuke,' the 'totheion,' the 'archeus,' the 'anima mens,' and the '*vital principle*,' have each in their turn animated the matter of a human body. If any principle of philosophy that cannot be proved be assumed to explain the phenomena of Nature, it explains no more than the assumer's ignorance, it certainly betrays his want of knowledge of the operations of Nature, which, instead of concealing under the title of *imposing words*, he should have confessed,

The same cause, acting on different substances, will produce different effects. If, therefore, the motion of a watch differs from that of a vital body, it is owing entirely to the difference of the two substancês. We might as well refer the motions of a fermenting butt of porter to a vital principle, as to ascribe vital motion to any principle that is not mechanical. And if the motion of life cannot be demonstrated by lines and angles, it should be remembered, that the motion of fermentation, which no one calls vital, is equally incapable of demonstration. Vital motion is too subtle for the cognizance of our gross senses. It is quite imaginary to talk of moral motion, independent of a mechanical, or physical, or chemical principle (all of which are the same in principle); we know no such moral motion; we can prove it only to be a term, which is used to characterize a certain established order of motion or action, which mankind have experienced to be orderly and harmonious, and to be conducive to the interests of society.

in order that the “*spirit*” of investigation might not be checked. For the odour of the rose, the sound of the flute, and the polarity of the magnet might, with the same propriety, be called a principle directing and regulating these substances, as the phenomena of life be said to be an “*archeus*,” an “*anima mens*,” or a “vital principle.”

In the writings of Pleuk, who, as a chemical enquirer, more particularly deserves our attention, we find the hypothesis of the above-mentioned authors expressed in the words “*peculiar element of life*.” This, he says, is the *cause* of the affinities that unite the constituent parts of bodies, and supposes that, by means of its influence, living matter is exempted from the government of chemical laws, and that death and putrefaction are the consequences of the cessation of this peculiar element. He distinguishes between living and dead matter by saying that the latter, being deprived of the “*peculiar element*,” becomes obedient to chemical affinity.

As we are not told by Pleuk what the element is, the laws by which it is governed, or its affinity with known matter, we can understand it to be neither more nor less than an element of his *own* creating. It is impossible to have a true idea of an element within the atmosphere of the planet earth, that is not subject to affinity. If such an element do exist, of what importance, as an unal-

lied body, can it be in organizing matter? In itself it can form nothing, for no homogeneous body can act upon itself, and form heterogeneous compounds: in uniting with other matter, which it must do in order to effect organization, it must become obedient to the laws of affinity, and its nature must be changed. By a law of chemistry, when two substances of different natures are united, a compound is formed, different from the respective substances. Pleuk having taken it for granted that the laws which govern living and dead matter are different, he labours, if we rightly comprehend him, to draw the line of distinction between them, by making use of *his own element* to govern living matter. Before, however, *any* peculiar element be assumed, to found a distinction between living and dead matter, it should be shown that living matter, which can be demonstrated to be different from dead, by the known quantities of the contained matter, is not sufficient in itself to explain the phenomena of life. A living body decomposes atmospheric air and receives oxigene, a dead body does not; in the latter, therefore, there is a material difference, occasioned by the loss of its oxigene, which explains the death of the body, without the necessity of calling in a “peculiar element*.”

* It does not seem to be understood, that the changes in matter are according to a law which never changes. Since the existence of the elements of matter (and when that began we leave for time to decide upon), it was a law, that when certain kinds of them met, an alkali should be formed. The alkali thus

Analysis teaches us, that the vast variety of substances is owing to the proportions in which the same elements are united. In an animal body, the elements are more numerous, or more infinitely united, than in other bodies, and must consequently exhibit phenomena different from every other body, that does not contain the same elements, united precisely in the same proportions. An acid, an alkali, an earth, and a stone, differ as much from each other as the whole differs from a living body ; and if a “ peculiar law” govern living matter, there is no reason why a peculiar law should not govern every dissimilar form of Nature’s production. It should therefore first be proved, before any new law is admitted in the government of living matter, that living and dead matter are precisely the same : we repeat it, precisely the same ; *for until different*

formed can be acted upon by heat, and its elements again set free. These changes are what are called composition and decomposition, and are in consequence of the action of the respective matters, or elements. Now, as these changes are the necessary result of the action of different matters upon one another, and as we have no knowledge of their ever having acted differently, we say, that the changes are according to a law which never changes. That change of matter termed death, is as natural to a human body as it is to the alkali, because both are heterogeneous compounds, and obey the law that never changes. The difference of the duration of their form and shape is owing entirely to the cohesion or quiescent affinity which retains their particles. In the alkali it is strong, and requires a powerful divellent substance to separate it ; in the human body it is so weak that very slight causes disunite it : hence the decomposition of an alkali and the death of a human body necessarily happen.

effects arise from the same substances, placed precisely in the same circumstances, the law which governs matter cannot, in strict language, be called a different law. All bodies that contain the same elements are governed by the same laws. Pure air supports flame, and pure air supports life. A human body requires oxigene, and cannot live without it; a lighted candle requires oxigene, and cannot burn without it: they are therefore both governed by the same law; and though they manifest different phenomena, it is owing to the difference of their matters, and not to the difference of the law which governs them, for if this were the case, every different substance would require a different law, which would be endless.

Pythagoras first asserted, that fire was the universal principle of animation, in which opinion he was followed by Heraclitus and others, whom it is of no consequence to mention. System makers, availing themselves of such high authorities, have assumed electricity (the modification of it) to be the vital principle. We would barely ask of such contrivers, what principle of life electricity possesses in itself? whether it can act upon itself, and form a nerve, a muscle, or a bone? it is one of the elements of the body, and no greater constituent in the organization of matter than the rest. Why should not other particles of matter have a share of the vital principle? Such as believe the electric fluid to be the vital principle, unknowingly

reduce life to chemical affinity, and tacitly admit what they have loudly denied, viz. that the laws which govern living and dead matter are the same.

The late discovery of galvanism has not escaped the ingenuity of theorists, who have found in it a *new* vital principle. The remarks on electricity apply equally to galvanism, and whatever specific properties it may have, the senses recognize in it, by its exploding gunpowder, &c. nothing but the element fire. Besides, the contact of two substances is necessary for the production of it, and these must have an affinity for oxigene, or it is not made evident. Thus, zinc and copper discover it, but wood does not ; the affinity of it is therefore demonstrated, by which its “vital principle” is confounded.

Galvanism, like Mr. Hunter’s “vitality of the blood,” proves less than the advocates of it wish, yet proves more than they intend ; for as the vitality of the latter consists in its chemical quantities, so the vital principle of the former consists in its chemically combining with the matter of the body, whereby it contributes to the production of the phenomena of life.

The materiality of life is demonstrated by means of galvanism in a single experiment.

The muscular contractions re-excited in a dead body, by the agency of galvanism, are the silent expression of a truth, which metaphysical jargon cannot confound. Here we may behold the restoration of life, not by the exertion of any "vital power," nor by the influence of any self independent principle, but by the combination of matter with matter. But this fact, in our imagination, admits of no conclusion, and even after seeing a drowned corpse "*forced*" *into life* by galvanism, electricity, inflation, and various other stimulating matter, we would exclaim, "the vital principle was not extinguished." But what is that vital principle? Is it words, or is it a substance? In the present state of our knowledge it is only known, that when the affinities of the body are quiescent, or when its attraction of cohesion is entire, animation can be restored, but when the divellent affinity prevails over the quiescent, putrefaction takes place.

Why does a muscle contract a few minutes after death, and not many hours afterwards? To ascribe the latter circumstance to a vital principle is saying nothing to the purpose, it is expressive merely of the change, which should be referred to its *material* alteration, and this again to new combinations which have taken place in consequence of the destruction of the quiescent affinity.

In cases of death from electricity, the blood is dissolved, and the cohesion of the fibre weakened. Here the decomposition is at *once* effected, which prevents resuscitation. Now had one out of the hundred of such cases been resuscitated, we have a right to conclude, from the facts of the rest, that in it the state of the decomposition was such as to admit of stimuli being effectual, and of oxigene chemically combining with the blood in the necessary proportion, so as to restore life. In a course of experiments lately made by a distinguished chemist of France, it was discovered, that a recently dead body exhales an acid gas, which continues a certain time (not stated), during which resuscitation may be effected; but that as soon as it has ceased an *alkaline* gas is emitted, which becomes a diagnostic of the irrecoverable state of the body: now as this acid gas does not particularly exhale from a body excepting in a state of disease, which has a tendency to decomposition, the presumption is, that as soon as respiration ceases decomposition begins, and proceeds more or less rapidly, according to the nature and violence of the cause which induced it. When, therefore, a dead body appears entire to the eye, and in nowise different from a living one in respect to its matter, it must not be concluded that it is the same, and that a particular principle only has ceased its influence. And instead of searching for life in an independent principle, the enquirer after it should study the nature of the body; the actual state of its matter; its res-

pective affinities and relations with external agents ; and the changes wrought in the body by impressions internally and externally applied ; and he should study the sum of the matters of organization, and the sum of the matters of motion, sensation, and thought, together with the changes that take place in it, from the first diminution of motion to its final extinction. If the knowledge of all these phenomena does not explain life, *we* may then adopt a “ vital principle,” or a “ peculiar element.”

The arguments of the theorists of the vital principle remain for our examination. It is urged in favour of the existence of the vital principle, that the seed, unlike every other form of matter, has a power of vegetation, when buried in the earth, or immersed in water : the vegetation, therefore, it is said, is the effect of the vital principle. But in the growth of the seed the co-operation of the soil is admitted, and why not admit the soil itself to have a vital principle ? Does it grow in vacuo, or does it bud and blossom in the bosom of its “ mother earth,” in her “ vivifying streams,” and in her “ vital ether ?” By a law of chemistry (the law of Nature), when two substances of different natures are united, a compound is formed different from the substances employed, as in the production of a neutral salt by the union of an acid and an alkali, or in the production of a *neuter*, by the conjunction of animals of different genus. Now whether the principle of forming the salt belongs exclusively to the

acid or the alkali, is of as much consequence to determine, as it would be to decide whether the principle of vision exist in the eye or the object viewed, or whether the eye have a principle of seeing a cathedral, before it reflected the rays of light : just so it is with the seed, for, reasoning a priori, it has no more vitality than a grain of sand, or a rock of granite.

It is further said, that a seed will lose its power of germination, if it be slightly baked in an oven : another proof, it is supposed, of the vital principle. But no inference whatever, in favour of it, can be drawn from this fact ; as much would be signified by saying the seed has undergone a change, as by asserting that it has lost a principle, and until this be discovered, the fact is more strictly expressed by the word change. If, after fair experiment, the seed be found exempted from the law of heat, which tends to vary the particles of matter, and modify their natures ; when it shall have been proved, that “ different effects will arise from the same substances, placed precisely in the same circumstances,” then it may be said, that a principle is discovered independent of chemical affinity ; but until the identity of the two seeds has been proved, and that the combination of heat with one of them produced no effect, this conclusion not only betrays an ignorance of a vital principle, but also an inexcusable ignorance of the laws of matter.

Such are the theories, and such are the *arguments* of the believers in the “vital principle:” thus, in human science, words are coined for facts, and ideal laws assigned to man, by which he can claim no right of existence.

Having thus briefly, but amply, reviewed the science of life, as it has been delivered to us by philosophers of the highest reputation, we proceed to detail the experiments upon which our fundamental propositions were grounded. But before we do this, we beg leave to submit a few chemical observations, that have an intrinsic relation with the subject.

The *elements* of *organized* bodies are electricity, oxygen, hydrogen, carbon, azote, phosphorus, and lime, which unite and combine, and form compounds of various forms and qualities, according to the numbers and proportions of them. Thus, the conversion of alimentary matters into chyle, blood, muscle, nerve, and bone, are demonstrations of the variety of chemical organization. But the difference of the properties of the same elements, in forming substances of different dimensions, consistencies, and qualities, is strikingly illustrated in the Arabian gum, and in the poison of the viper; they both contain the same number of elements, and both have opposite dimensions, consistencies, and qualities. The same, though in a less degree, is observed in the animal, the vegeta-

ble, and the alkali; these contain the same elements, in numbers and proportions peculiar to each; hence a *material* reason why the human body should differ from every other, that does not contain the "same elements, united precisely in the same proportions," and under the same circumstances.

Chemistry, though confined in synthesis, or formation, yet ascertains the last decomposition of all bodies that enter the laboratory; and though foiled in the assay of organization, she does not ascribe the failure to the want of a "peculiar element," but to an ignorance of the proportions of the elements that constitute an organized body. The chemist does not endeavour to find out these proportions, nor does he, as it is wittily said, expect to "compose an animal;" he well knows, that there is but one laboratory for that kind of organization; yet having discovered, in the decomposition and recomposition of water, that synthesis confirms analysis, he concludes, from analytical induction, that a human body is chemically organized; and having seen that decomposition begins the next moment after respiration ceases, he also concludes, that the body was chemically kept alive by means of oxigene and other chemical agents.

In the application of chemistry to explain the phenomena of life, we speak of elements which have been seen and felt, nor have we as yet had

reasons for believing that they are compounds of others. Some of them, without doubt, are created by decomposition; but at the same time we are certain, that not a particle of the total matter was thereby destroyed, and it is of no consequence how far those which we call elements are compounded, as the last series of them must still be matter, and subject to affinity, or they could not have been transformed into the supposed elements of a body; and the idea of a single element producing others is a solecism. No homogeneous body can act upon itself and form heterogeneous compounds; the labour, therefore, of calculating the infinities for the single element may be saved.

EXPERIMENTS.

In the analysis of the egg, we obtain oxigene, hydrogene, carbone, and azote; phosphorus and lime, like the rest of the substances which it contains, may be compounds. After its fœcundation and deposition, we observe it in its perfect state, without any characteristic of life, and without any indication by which (reasoning a priori) the evolution of a chick could be anticipated. Like all lifeless matter, it is subject to the common law of heat, and its supposed “vital power” of resisting cold is in common with other matter. Thus, water sinks a degree below the freezing point, before it becomes solid, and mercury congeals at 73 below the cypher.

In the agency of heat and air we observe three effects.

1. In the temperature of 103, and in atmospheric air, it undergoes changes, by which the chick is generated.

2. In atmospheric air and below 103, and in 103 and out of atmospheric air, it experiences decomposition and putrefaction.

3. When the chick is evolved and moving in the shell, the privation of atmospheric air occasions its decomposition or death.

In all these experiments we do not discern an independent vital principle. The egg in its recent state was conformable to the law of matter ; the changes in it were wrought by means of air and heat, and, when motion had begun, it subsided and ceased by wanting one of the constituent elements, viz. the pure part of atmospheric air.

By means of the egg, then, Nature permits chemistry to flash a gleam upon the phenomena of life. The chemist has now shown an egg begotten, hatched, and vitalised by matter, and has brought *material* proof, that the “ peculiar element ” is nothing but common matter. In his own language, therefore, he concludes, that organization consists in the union of chemical elements, according to a law (the law of necessity), and that muscular motion, sensation, and thought result from the constant and indispensable action of the same elements, according to the same law, in the forms of light, heat, air, and food.

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